SYSTEM FOR DISCONNECTING COILED TUBING

Background

[0001] This invention relates generally to oil and gas wells, and in particular to systems for controlling coiled tubing for oil and gas wells.

[0002] During the operation of an oil and gas well, coiled tubing is frequently positioned in the well to perform tasks such as, for example, sand cleanout of the well, plugging the well with cement, acidizing the formation, operating equipment within the well, and well intervention operations. During the operation of offshore oil and gas wells, the use of coiled tubing to perform such tasks can create significant safety hazards to equipment and personnel in the event of a well malfunction. For example, if the operating pressures within the well become excessive, the operating pressure within the coiled tubing may also be excessive. If the coiled tubing must be disconnected during such a situation in order to prevent a catastrophic accident, the free end of the coiled tubing may tend to whip around the area proximate the offshore platform. As a result, the free end of the coiled tubing may impact with the offshore platform and the personnel in the area. Furthermore, the contents of the free end of the coiled tubing may be released to the atmosphere and could be sprayed on personnel and equipment

a considerable distance from the point at which the coiled tubing was cut. The contents of the coiled tubing could also be highly flammable and/or toxic to personnel. Conventional systems for disconnecting coiled tubing on offshore platforms do not prevent or minimize such hazards when the coiled tubing is disconnected.

[0003] The present invention is directed to overcoming one or more of the limitations of existing systems for disconnecting coiled tubing.

Brief Description of the Drawings

[0004] Fig. 1a is an illustration of an embodiment of a system for disconnecting coiled tubing in an initial state.

[0005] Fig. 1b is an illustration of the system of Fig. 1a after closing the pipe and the slip rams.

[0006] Fig. 1c is an illustration of the system of Fig. 1b after closing the shear rams to shear the coiled tubing.

[0007] Fig. 1d is an illustration of the system of Fig. 1c after extending the actuator assembly.

[0008] Fig. 1e is an illustration of the system of Fig. 1d after further extending the actuator and closing the blind rams.

[0009] Fig. 1f is an illustration of the system of Fig. 1e after further extending the actuator assembly to bleed pressure out of an open end of the sheared coiled tubing.

[0010] Fig. 1g is an illustration of the system of Fig. 1f after opening some of the pipe and shear rams to release a section of the sheared coiled tubing.

[0011] Fig. 1h is an illustration of the system of Fig. 1g after releasing an end of the sheared coiled tubing from the system.

[0012] Fig. 2a is an illustration of another embodiment of a disconnect system for coiled tubing in an initial position.

[0013] Fig. 2b is an illustration of the system of Fig. 2a after engaging, shearing, and crimping the coiled tubing.

[0014] Fig. 2c is an illustration of the system of Fig. 2b after releasing the sheared and crimped ends of the coiled tubing.

[0015] Fig. 2d is an illustration of the system of Fig. 2c after one of the released, sheared ends of the coiled tubing is released from the system into the water adjacent the offshore platform.

[0016] Fig. 2e is an illustration of the sheared end of the released end of the coiled tubing floating in the water adjacent the offshore platform.

[0017] Fig. 3a is a top view of an embodiment of the first top crimp and cut clamp of the system of Fig. 2a.

[0018] Fig. 3b is a side view of the first top crimp and cut clamp of Fig. 3a.

[0019] Fig. 3c is an end view of the first top crimp and cut clamp of Fig. 3a.

[0020] Fig. 3d is another end view of the first top crimp and cut clamp of Fig. 3a.

[0021] Fig. 3e is a cross-sectional view of the first top crimp and cut clamp of Fig. 3a.

[0022] Fig. 3f is a top view of the housing of the first top crimp and cut clamp of Fig. 3a.

[0023] Fig. 4a is a top view of an embodiment of the first bottom crimp and cut clamp of the system of Fig. 2a.

[0024] Fig. 4b is a side view of the first bottom crimp and cut clamp of Fig. 4a.

[0025] Fig. 4c is an end view of the first bottom crimp and cut clamp of Fig. 4a.

[0026] Fig. 4d is another end view of the first bottom crimp and cut clamp of Fig. 4a.

[0027] Fig. 4e is a cross-sectional view of the first bottom crimp and cut clamp of Fig. 4a.

[0028] Fig. 4f is a top view of the housing of the first bottom crimp and cut clamp of Fig. 4a.

[0029] Fig. 5a is a top view of an embodiment of the second top crimp and cut clamp of the system of Fig. 2a.

[0030] Fig. 5b is a side view of the second top crimp and cut clamp of Fig. 5a.

[0031] Fig. 5c is an end view of the second top crimp and cut clamp of Fig. 5a.

[0032] Fig. 5d is another end view of the second top crimp and cut clamp of Fig. 5a.

[0033] Fig. 5e is a cross-sectional view of the second top crimp and cut clamp of Fig. 5a.

[0034] Fig. 5f is a top view of the housing of the second top crimp and cut clamp of Fig. 5a.

[0035] Fig. 6a is a top view of an embodiment of the second bottom crimp and cut clamp of the system of Fig. 2a.

[0036] Fig. 6b is a side view of the second bottom crimp and cut clamp of Fig. 6a.

[0037] Fig. 6c is an end view of the second bottom crimp and cut clamp of Fig. 6a.

[0038] Fig. 6d is another end view of the second bottom crimp and cut clamp of Fig. 6a.

[0039] Fig. 6e is a cross-sectional view of the second bottom crimp and cut clamp of Fig. 6a.

[0040] Fig. 6f is a top view of the housing of the second bottom crimp and cut clamp of Fig. 6a.

[0041] Figs. 7a-7c are illustrations of another embodiment of a disconnect system for coiled tubing.

Description of the Preferred Embodiments

[0042] Referring to Fig. 1a, the reference numeral 10 refers, in general, to an embodiment of a disconnect system for coiled tubing that includes a conventional slip ram assembly 12 that defines a passage 12a for receiving coiled tubing 14 that includes slip rams, 12ba and 12bb, and corresponding actuators, 12ca and 12cb, for actuating the slip rams to controllably engage the coiled tubing 14 and a pair of flanges, 12d and 12e, at opposite ends of the slip ram assembly 12. A conventional pipe ram assembly 16 is provided that defines a passage 16a for receiving the coiled tubing 14 and includes pipe rams, 16ba and 16bb, and corresponding actuators, 16ca and 16cb, for actuating the pipe rams to controllably engage the coiled tubing 14, a flange 16d at one end that is coupled to the flange 12e of the slip ram, and a flange 16e at another end.

The combination of the slip ram assembly 12 and the pipe ram assembly 16 may be provided as a conventional single blow out preventor (BOP) assembly commercially available from Halliburton Energy Services, Inc.

[0043] An actuator assembly 18 is provided that includes an inner sleeve 18a that defines a passage 18aa for receiving the coiled tubing 14 and a flange 18ab at one end that is coupled to the flange 16e of the pipe ram assembly 16. An outer sleeve 18b defines a passage 18ba for receiving the inner sleeve 18a and radial vent passages, 18bba and 18bbb, and includes a flange 18bc at one end. Shear pins, 18ca and 18cb, releasably couple the inner and outer sleeves, 18a and 18b, together in a stationary relationship and sealing members, 18da, 18db, 18dc, and 18dd, are coupled to the inner sleeve 18a for sealing the interface between the inner and outer sleeves, 18a and 18b, respectively. Hydraulic actuators, 18e and 18f, include pistons, 18ea and 18fa, respectively, that include flanges, 18eb and 18fb, at one end that are coupled to the flange 18ab. The pistons, 18ea and 18fa, are movably received within piston chambers, 18ec and 18fc, respectively, that are defined within cylinders, 18ed and 18fd, respectively, that are coupled at one end to the flange 18bc.

[0044] A conventional blind ram assembly 20 is provided that defines a passage 20a for receiving the coiled tubing 14 and includes blind rams, 20ba and 20bb, and corresponding actuators, 20ca and 20cb, for actuating the blind rams to controllably close off the passage 20a, a flange 20d at one end that is coupled to the flange 18bc of the actuator assembly 18, and a flange 20e at another end. A conventional shear ram assembly 22 is provided that defines a passage 22a for receiving the coiled tubing 14

and includes shear rams, 22ba and 22bb, and corresponding actuators, 22ca and 22cb, for actuating the shear ram to controllably shear the coiled tubing 14, a flange 22d at one end that is coupled to the flange 20e of the blind ram assembly 20, and a flange 22e at another end. A conventional pipe ram assembly 24 is provided that defines a passage 24a for receiving the coiled tubing 14 and includes pipe rams, 24ba and 24bb, and corresponding actuators, 24ca and 24cb, for actuating the pipe rams to controllably engage the coiled tubing 14, a flange 24d at one end that is coupled to the flange 22e of the shear ram assembly 22, and a flange 24e at another end. A conventional slip ram assembly 26 is provided that defines a passage 26a for receiving the coiled tubing 14 and includes slip rams, 26ba and 26bb, and corresponding actuators, 26ca and 26cb, for actuating the slip rams to controllably engage the coiled tubing 14, a flange 26d at one end that is coupled to the flange 24e of the pipe ram assembly 24, and a flange 26e at another end that is coupled to an offshore platform 28. The combination of the blind ram assembly 20, the shear ram assembly 22, the pipe ram assembly 24, and the slip ram assembly 26 may be provided as a conventional quad BOP assembly commercially available from Halliburton Energy Services, Inc.

[0045] An end 14a of the coiled tubing 14 extends out of the flange 12d of the slip ram assembly 12 into a conventional undersea wellbore below the surface of the water, and the other end 14b of the coiled tubing 14 extends out of the flange 26e of the slip ram assembly 26 to a conventional reel of coiled tubing. In this manner, the coiled tubing 14 may be dispensed off of the reel into the undersea wellbore.

[0046] During operation, as illustrated in Fig. 1b, the end 14a of the coiled tubing 14 may be disconnected from the end 14b of the coiled tubing by closing the pipe rams and slip rams, 12ba, 12bb, 16ba, 16bb, 24ba, 24bb, 26ba, and 26bb, of the slip and pipe ram assemblies, 12, 16, 24, and 26. In this manner, the coiled tubing 14 is engaged by the pipe and slip rams, 12ba, 12bb, 16ba, 16bb, 24ba, 24bb, 26ba, and 26bb, and held in a stationary position within the passages 12a, 16a, 18a, 20a, 22a, 24a, and 26a of the disconnect system 10.

[0047] As illustrated in Fig. 1c, the shear rams, 22ba and 22bb, of the shear ram assembly 22 are then actuated to shear the coiled tubing 14 within the passage 22a thereby forming sheared ends, 14c and 14d. In an exemplary embodiment, the shear rams, 22ba and 22bb, are further adapted to crimp the sheared end 14d of the coiled tubing 14.

[0048] As illustrated in Fig. 1d, the hydraulic actuators, 18e and 18f, of the actuator assembly 18 are then actuated by injecting a pressurized fluid into the piston chambers, 18ec and 18fc, using corresponding pumps, 30a and 30b. As a result, the shear pins, 18ca and 18cb, are sheared, and the pistons, 18ea and 18fa, are driven in a direction out of the piston chambers, 18ec and 18fc, thereby extending the length of the hydraulic actuators, 18e and 18f. As a result, the flanges, 18ab and 18bc, of the inner and outer sleeves, 18a and 18b, are driven away from each other thereby extending the overall length of the actuator assembly 18 and thereby moving the sheared ends, 14c and 14d, of the coiled tubing 14 away from each other.

[0049] As illustrated in Fig. 1e, once the sheared end 14c of the coiled tubing 14 has been moved beyond the blind rams, 20ba and 20bb, of the blind ram assembly 20, the blind rams are actuated to thereby close off the passage 20a. In this manner, the sheared ends, 14c and 14d, of the coiled tubing 14 are isolated from one another.

[0050] As illustrated in Fig. 1f, the hydraulic actuators, 18e and 18f, of the actuator assembly 18 are further actuated by further injecting a pressurized fluid into the piston chambers, 18ec and 18fc. As a result, the pistons, 18ea and 18fa, are further driven in a direction out of the piston chambers, 18ec and 18fc, thereby further extending the length of the hydraulic actuators, 18e and 18f. As a result, the flanges, 18ab and 18bc, of the inner and outer sleeves, 18a and 18b, are further driven away from each other thereby further extending the overall length of the actuator assembly 18 and thereby moving the sheared ends, 14c and 14d, of the coiled tubing 14 further away from each other. Furthermore, the further relative displacement of the inner and outer sleeves, 18a and 18b, of the actuator assembly 18 exposes the radial passages, 18bba and 18bbb, thereby permitting pressurized fluids within the end 14a of the coiled tubing 14 to be exhausted through the sheared end 14c of the coiled tubing 14 out of the disconnect system 10 through the radial passages, 18bba and 18bbb. In this manner, pressurized, and possibly flammable and/or toxic, fluidic materials within the end 14a of the coiled tubing 14 may be controllably vented out of the coiled tubing 14.

[0051] As illustrated in Figs. 1g and 1h, the pipe and slip rams, 12ba, 12bb, 16ba, and 16bb, of the pipe and slip ram assemblies, 12 and 16, are then actuated to release the end 14a of the coiled tubing 14. As a result, the de-pressurized end 14a of

the coiled tubing 14 may now be safely dropped into the water proximate the offshore platform 28.

[0052] Thus, the disconnect system 10 provides a safe and highly efficient system for disconnecting coiled tubing 14. As a result, in the event of an emergency situation such as, for example, a blow out, the end 14a of the coiled tubing 14 may be quickly and safely disconnected from the end 14b of the coiled tubing 14 thereby preventing damage to the remaining portion of the offshore production platform 28. Furthermore, the pressurized, and possibly toxic and/or flammable, fluidic materials within the end 14a of the coiled tubing 14 may be controllably vented thereby minimizing potential hazards to equipment and personnel.

[0053] Referring to Fig. 2a, the reference numeral 100 refers, in general, to another embodiment of a disconnect system for coiled tubing that includes a housing 102 that defines a passage 102a for receiving coiled tubing 104, a first top chamber 102b for receiving the coiled tubing 104 and a first top crimp and cut clamp 106, a first bottom chamber 102c for receiving the coiled tubing 104 and a first bottom crimp and cut clamp 108, a passage 102d for receiving the coiled tubing 104, a second top chamber 102e for receiving the coiled tubing 104 and a second top crimp and cut clamp 110, a second bottom chamber 102f for receiving the coiled tubing 104 and a second bottom crimp and cut clamp 112, a passage 102g for receiving the coiled tubing 104, passages 102h, 102i, 102j, and 102k, and a passage 102l for receiving the coiled tubing 104 and a tubular floatation device 114 defining a passage 114a for receiving the

coiled tubing 104. In an exemplary embodiment, the housing 102 is coupled to an offshore platform 103 such as, for example, the deck of a floating offshore vessel.

[0054] As illustrated in Figs. 3a, 3b, 3c, 3d, 3e, and 3f, the first top crimp and cut clamp 106 includes a housing 106a that defines a first rectangular channel 106aa for receiving the coiled tubing 104, a recess 106ab, a recess 106ac, a recess 106ad, a recess 106ae, a recess 106af, a semi-circular channel 106ag for receiving the coiled tubing 104, and a plurality of circular openings 106aha-106ahl, and includes a plurality of guide pins 106aia-106aij, a shear blade 106aj for shearing the coiled tubing 104, and a support member 106ak. Gaskets, 106ba and 106bb, are coupled to the top surface of the housing 106a, and a pipe ram 106c is supported within the recess 106ab of the housing 106a between ends of the gaskets, 106ba and 106bb, proximate the rectangular channel 106aa. A slip ram 106d is supported within the recess 106ac of the housing 106a between the pipe ram 106c and the recess 106ad, and a crimp and gripper pad 106e is supported within the recess 106ae of the housing 106a between the recess 106ad and the shear blade 106aj. A blind ram 106f is supported within the recess 106af of the housing 106a between the other ends of the rubber gaskets, 106ba and 106bb, and between the shear blade 106aj and the semi-circular channel 106ag.

[0055] As illustrated in Figs. 4a, 4b, 4c, 4d, 4e, and 4f, the first bottom crimp and cut clamp 108 includes a housing 108a that defines a first rectangular channel 108aa for receiving the coiled tubing 104, a recess 108ab, a recess 108ac, a recess 108ad, a recess 108ae, a recess 108af, a semi-circular channel 108ag for receiving the coiled tubing 104, and a plurality of circular openings 108aha-108ahj for mating with the guide

pins 106aia-106aij of the first top crimp and cut clamp 106, and includes a plurality of guide pins 108aia-108ail for mating with the circular openings 106aha-106ahl of the first top crimp and cut clamp 106, a shear blade 108aj for mating with the shear blade 106aj of the first top crimp and cut clamp 106 and thereby shearing the coiled tubing 104, and a support member 108ak. Gaskets, 108ba and 108bb, are coupled to the top surface of the housing 108a, and a pipe ram 108c is supported within the recess 108ab of the housing 108a between ends of the gaskets, 108ba and 1108bb, proximate the rectangular channel 108aa. A slip ram 108d is supported within the recess 108ac of the housing 108a between the pipe ram 108c and the recess 108ad, and a crimp and gripper pad 108e is supported within the recess 108ae of the housing 108a between the recess 108ad and the shear blade 108aj. A blind ram 108f is supported within the recess 108af of the housing 108a between the other ends of the gaskets, 108ba and 108bb, and between the shear blade 108aj and the semi-circular channel 106ag.

[0056] The support members, 106ak and 108ak, of the first top and bottom crimp and cut clamps, 106 and 108, respectively, are operably coupled to actuators, 116 and 118, respectively, for controllably displacing the first top and bottom crimp and cut clamps, 106 and 108, respectively, toward the coiled tubing 104. In this manner, the pipe rams, 106c and 108c, and the slip rams, 106d and 108d, of the first top and bottom crimp and cut clamps, 106 and 108, may cooperatively engage the coiled tubing 104. Furthermore, in this manner, the crimp and gripper pads, 106e and 108e, and the shear blades, 106aj and 108aj, of the first top and bottom crimp and cut clamps, 106 and 108, may cooperatively grip, shear, and crimp the coiled tubing 104. Finally, the

blind rams, 106f and 108f, of the first top and bottom crimp and cut clamps, 106 and 108, may cooperatively engage the coiled tubing 104.

[0057] As illustrated in Figs. 5a, 5b, 5c, 5d, 5e, and 5f, the second top crimp and cut clamp 110 includes a housing 110a that defines a first rectangular channel 110aa for receiving the coiled tubing 104, a recess 110ab, a recess 110ac, a recess 110ad, a recess 110ae, a recess 110af, a semi-circular channel 110ag for receiving the coiled tubing 104, and a plurality of circular openings 110aha-110ahl, and includes a plurality of guide pins 110aia-110aij, a shear blade 110aj for shearing the coiled tubing 104, and a support member 110ak. Gaskets, 110ba and 110bb, are coupled to the top surface of the housing 110a, and a pipe ram 110c is supported within the recess 110ab of the housing 110a between ends of the gaskets, 110ba and 110bb, proximate the rectangular channel 110aa. A slip ram 110d is supported within the recess 110ac of the housing 110a between the pipe ram 110c and the recess 110ad, and a crimp and gripper pad 110e is supported within the recess 110ae of the housing 110a between the recess 110ad and the shear blade 110aj. A blind ram 110f is supported within the recess 110af of the housing 110a between the other ends of the rubber gaskets, 110ba and 110bb, and between the shear blade 110aj and the semi-circular channel 110ag.

[0058] As illustrated in Figs. 6a, 6b, 6c, 6d, 6e, and 6f, the second bottom crimp and cut clamp 112 includes a housing 112a that defines a first rectangular channel 112aa for receiving the coiled tubing 104, a recess 112ab, a recess 112ac, a recess 112ad, a recess 112ae, a recess 112af, a semi-circular channel 112ag for receiving the coiled tubing 104, and a plurality of circular openings 112aha-112ahj for mating with the

guide pins 110aia-110aij of the second top crimp and cut clamp 110, and includes a plurality of guide pins 112aia-112ail for mating with the circular openings 110aha-110ahl of the second top crimp and cut clamp 110, a shear blade 112aj for mating with the shear blade 110aj of the second top crimp and cut clamp 110 and thereby shearing the coiled tubing 104, and a support member 112ak. Gaskets, 112ba and 112bb, are coupled to the top surface of the housing 112a, and a pipe ram 112c is supported within the recess 112ab of the housing 112a between ends of the gaskets, 112ba and 112bb, proximate the rectangular channel 112aa. A slip ram 112d is supported within the recess 112ac of the housing 112a between the pipe ram 112c and the recess 112ad, and a crimp and gripper pad 112e is supported within the recess 112ae of the housing 112a between the recess 112ad and the shear blade 112aj. A blind ram 112f is supported within the recess 112af of the housing 112a between the other ends of the gaskets, 112ba and 112bb, and between the shear blade 112aj and the semi-circular channel 110ag.

[0059] The support members, 110ak and 112ak, of the second top and bottom crimp and cut clamps, 110 and 112, respectively, are operably coupled to actuators, 120 and 122, respectively, for controllably displacing the second top and bottom crimp and cut clamps, 110 and 112, respectively, toward the coiled tubing 104. In this manner, the pipe rams, 110c and 112c, and the slip rams, 110d and 112d, of the second top and bottom crimp and cut clamps, 110 and 112, may cooperatively engage the coiled tubing 104. Furthermore, in this manner, the crimp and gripper pads, 110ae and 112ae, and the shear blades, 110aj and 112aj, of the second top and bottom crimp

and cut clamps, 110 and 112, may cooperatively grip, shear, and crimp the coiled tubing 104. Finally, the blind rams, 110af and 112af, of the second top and bottom crimp and cut clamps, 110 and 112, may cooperatively engage the coiled tubing 104.

[0060] During initial operation of the system 100, as illustrated in Fig. 2a, the coiled tubing 104 passes through the passage 102a, the first top chamber 102b, the first bottom chamber 102c, the passage 102d, the second top chamber 102e, the second bottom chamber 102f, the passage 102g, and the passage 102l of the housing 102, and the passage 114a of the floatation device 114. An end 104a of the coiled tubing 104 is wound about a conventional coiled tubing reel, and the other end 104b of the coiled tubing may be positioned in an undersea well using a conventional coiled tubing injector.

[0061] As illustrated in Figs. 2b, in order to disconnect the end 104a of the coiled tubing 104 from the other end 104b of the coiled tubing 104, the first and second top and bottom crimp and cut clamps, 106, 108, 110, and 112, are actuated into engagement with the coiled tubing 104. During the engagement of the first and second top and bottom crimp and cut clamps, 106, 108, 110, and 112, with the coiled tubing 104, the pipe rams, 106c, 108c 110c, 112c, and the slip rams, 106d, 108d, 110d and 112d, cooperatively engage the coiled tubing 104 and maintain the corresponding portions of the coiled tubing 104 in a stationary position. Furthermore, during the engagement of the first and second top and bottom crimp and cut clamps, 106, 108, 110, and 112, with the coiled tubing 104, the crimp and gripper pads, 106ae, 108ae, 110ae and 112ae, and the shear blades, 106aj, 108aj, 110aj and 112aj, may

cooperatively grip, shear, and crimp the corresponding portions of the coiled tubing 104. Finally, during the engagement of the first and second top and bottom crimp and cut clamps, 106, 108, 110, and 112, with the coiled tubing 104, the blind rams, 106af, 108af, 110af and 112af, may cooperatively engage the coiled tubing 104 and maintain the corresponding portions of the coiled tubing 104 in a stationary position.

[0062] As illustrated in Fig. 2c, the first and second top and bottom crimp and cut clamps, 106, 108, 110, and 112, are then actuated out of engagement with the coiled tubing 104. The end 104a of the coiled tubing 104 now includes a crimped and cut end 104aa, and the other end 104b of the coiled tubing 104 now includes a crimped and cut end 104ba. An intermediate free section of coiled tubing 104c is also formed. The outside diameter of the crimped and cut end 104aa of the end 104a of the coiled tubing 104 is greater than the inside diameter of the passages 102a and 102d of the housing 102, and the outside diameter of the crimped and cut end 104ba of the other end 104b of the coiled tubing 104 is greater than the inside diameter of the passage 114a of the floatation device 114. As a result, the crimped and cut end 104aa of the end 104a of the coiled tubing 104 is held within the first top and bottom chambers, 102b and 102c, thereby containing any fluidic materials within the end of the coiled tubing 104 and preventing the coiled tubing 104 from unspooling off of the coiled tubing reel. Furthermore, as a result, the crimped and cut end 104ba of the other end 104b of the coiled tubing 104 contains any pressurized, and possibly flammable and/or toxic, fluidic materials within the end of the coiled tubing 104 and the floatation device 114 is

retained on the other end 104b of the coiled tubing 104 by the crimped and cut end 104ba.

[0063] As illustrated in Figs. 2d and 2e, the other end 104b of the coiled tubing 104 may then be released from the housing 102, and off of the offshore platform 103. Because the floatation device 114 is retained on the other end 104b of the coiled tubing 104 by the crimped and cut end 104ba, the other end 104b of the coiled tubing 104 floats upon the surface of the water 124 adjacent to the offshore platform 103. In this manner, the other end 104b of the coiled tubing 104 may be retrieved from the water 124. Furthermore, because the end 104a of the coiled tubing 104 is sealed off by the crimped and cut end 104ba, pressurized, and possibly flammable and/or toxic, fluidic materials are not released to the atmosphere or sprayed on the equipment and personnel on the offshore platform 103.

[0064] Thus, the system 100 provides a safe and highly efficient system for disconnecting coiled tubing 104. As a result, in the event of an emergency situation such as, for example, a blow out, the end 104a of the coiled tubing 104 may be quickly and safely disconnected from the other end 104b of the coiled tubing thereby preventing damage to the remaining portion of the offshore platform 103. Furthermore, since both ends, 104a and 104b, of the coiled tubing 104 are sealed off by the cutting and crimping operation, pressurized, and possibly flammable and/or toxic, fluidic materials within the ends of the coiled tubing 104 are not released to the atmosphere or sprayed on equipment or personnel on the offshore platform 103.

[0065] Referring to Fig. 7a, the reference numeral 200 refers, in general, to another embodiment of a disconnect system for coiled tubing that includes a conventional pack off assembly 202 that includes a housing 202a that defines a passage 202aa for receiving coiled tubing 204, an annular chamber 202ab for receiving tubular slips 202b, a tubular pack off 202c, and an end of a tubular piston 202d that defines a passage 202da, an annular piston chamber 202ac for receiving another end of the tubular piston 202d and a spring element 202e, and a radial passage 202ad for controllably pressurizing the annular piston chamber 202ac. A tubular sleeve 202f that defines a passage 202fa for receiving the coiled tubing 204 is received within the passage 202da of the tubular piston 202d that includes a flange 202fb that is coupled to an end of the housing 202a. In an exemplary embodiment, the pack off assembly 202 is a conventional pack off assembly commercially available from Halliburton Energy Services, Inc.

[0066] A conventional tubing cutter valve assembly 206 is coupled to the conventional pack off assembly 202 that includes a tubular sleeve 206a that defines a passage 206aa for receiving the coiled tubing 204 and a flange 206ab that is coupled to the flange 202fb of the tubular sleeve 202f. An end of a housing 206b that defines a passage 206ba for receiving an end of the tubular sleeve 202f, an annular piston chamber 206bb for receiving a spring element 206c, and an end of a tubular piston 206d that defines a passage 206da for receiving the coiled tubing 204, a radial passage 206bc for pressurizing the annular piston chamber 206bb, an annular chamber 206bd for receiving another end of the tubular piston 206d, and a passage 206be for receiving

an end of a tubular sleeve 206e that defines a passage 206ea for receiving the coiled tubing 204 and includes a flange 206eb is coupled to the tubular sleeve 206a, and the other end of the housing 206b is coupled to the tubular sleeve 206e. A conventional cutter valve 206f is operably coupled to the tubular piston 206d for controllably cutting the coiled tubing 204 in a conventional manner. In an exemplary embodiment, the tubing cutter valve assembly 206 is a conventional Super Cutter™ Valve commercially available from Halliburton Energy Services, Inc.

[0067] A separator assembly 208 is coupled to the tubing cutter valve assembly 206 that includes a housing 208a that defines a passage 208aa for receiving the coiled tubing 204, an annular piston chamber 208ab for receiving a spring element 208b and a tubular piston 208c, a radial passage 208ac for pressurizing the annular piston chamber 208ab, and a passage 208ad for receiving an end of a tubular sleeve 208d defining a passage 208da for receiving the coiled tubing 204 and a flange 208db that is coupled to the tubular sleeve 206e of the tubing cutter valve assembly 206. Shear pins, 208e and 208f, releasably couple the other end of the housing 208a and the tubular sleeve 208d.

[0068] A conventional tubing cutter valve assembly 210 is coupled to the separator assembly 208 that includes a tubular sleeve 210a that defines a passage 210aa for receiving the coiled tubing 204 and a flange 210ab that is coupled to the flange 208db of the tubular sleeve 208d of the separator assembly 208. An end of a housing 210b that defines a passage 210ba for receiving an end of the tubular sleeve 210a, an annular chamber 210bb for receiving an end of a tubular piston 210c that

defines a passage 210ca for receiving the coiled tubing 204, an annular piston chamber 210bc for receiving another end of the tubular piston 210c and a spring element 210d, a radial passage 210bd for pressurizing the annular piston chamber 210bc, and a passage 210be for receiving an end of a tubular sleeve 210e that defines a passage 210ea for receiving the coiled tubing 204 and includes a flange 210eb is coupled to the tubular sleeve 210a, and the other end of the housing 210b is coupled to the tubular sleeve 210e. A conventional cutter valve 210f is operably coupled to the tubular piston 210c for controllably cutting the coiled tubing 204 in a conventional manner. In an exemplary embodiment, the tubing cutter valve assembly 210 is a conventional Super Cutter™ Valve commercially available from Halliburton Energy Services, Inc.

[0069] A conventional pack off assembly 212 is coupled to the conventional tubing cutter valve assembly 210 that includes a tubular sleeve 212a that defines a passage 212aa for receiving the coiled tubing 204 and a flange 212ab that is coupled to the flange 210eb of the tubular sleeve 210e of the tubing cutter valve assembly 210. A housing 212b that defines a passage 212ba for receiving an end of the tubular sleeve 212a, an annular piston chamber 212bb for receiving a spring element 212c and an end of a tubular piston 212d, a radial passage 212bc for pressurizing the annular piston chamber 212bb, an annular chamber 212bd for receiving another end of the tubular piston 212d, a tubular pack off 212e and a tubular slip 212f, and a passage 212be for receiving the coiled tubing 204 is coupled to the tubular sleeve 212a. In an exemplary embodiment, the pack off assembly 212 is a conventional pack off assembly commercially available from Halliburton Energy Services, Inc. In an exemplary

embodiment, the pack off assembly 212 is coupled to an offshore platform 214 such as, for example, the deck of a floating offshore vessel.

[0070] An end 204a of the coiled tubing 204 extends out of the passage 202aa of the housing 202a of the pack off assembly 202 into a conventional undersea wellbore below the surface of the water, and the other end 204b of the coiled tubing 204 extends out of the passage 212be of the housing 212b of the pack off assembly 212 to a conventional reel of coiled tubing. In this manner, the coiled tubing 204 may be dispensed off of the reel into the undersea wellbore.

[0071] During the initial operation of the system 200, the coiled tubing 204 passes through the passages 202aa, 202fa, 206aa, 206da, 206ea, 208aa, 208da, 210aa, 210ca, 210ea, 212aa, and 212be. The end 204a of the coiled tubing 204 may be wound about a conventional coiled tubing reel, and the other end 204b of the coiled tubing 204 may be positioned in an undersea well using a conventional coiled tubing injector. During the initial operation of the system 200, a pressurized fluid is injected into the annular piston chambers, 202ac, 206bb, 208ab, 210bc, and 212bb through the radial passages, 202ad, 206bc, 208ac, 210bd, and 212bc, respectively, at a predetermined operating pressure using a pump to thereby compress the spring elements, 202e, 206c, 208b, 210d, and 212c, respectively. In this manner, the coiled tubing 204 is free to pass through the passages 202aa, 202fa, 206aa, 206da, 206ea, 208aa, 208da, 210aa, 210ca, 210ea, 212aa, and 212be.

[0072] In order to disconnect the end 204a of the coiled tubing 204 from the other end 204b of the coiled tubing 204, the hydraulic pressure of the pressurized fluid

in the annular piston chambers, 202ac, 206bb, 208ab, 210bc, and 212bb is controllably reduced. In this manner, the spring elements, 202e, 206c, 208b, 210d, and 212c, may then displace the tubular pistons, 202d, 206d, 208c, 210c, and 212d, respectively, in a longitudinal direction away from the spring elements, 202e, 206c, 208b, 210d, and 212c, and thereby operate the pack off assemblies, 202 and 212, the tubing cutter valve assemblies, 206 and 210, and the separator assembly 208.

[0073] In an exemplary embodiment, the pack off assemblies, 202 and 212, are operated before the tubing cutter valve assemblies, 206 and 210, and the separator assembly 208, and the tubing cutter valve assemblies, 206 and 210, are operated before the separator assembly 208. In particular, in an exemplary embodiment, the tubular slips, 202b and 212f, and tubular pack offs, 202c and 212e, of the pack off assemblies, 202 and 212, respectively, are actuated by the displacement of the tubular pistons, 202d and 212d, and thereby engage the corresponding sections of the coiled tubing 204 and maintain the corresponding sections of the coiled tubing 204 in a stationary position. The cutter valves, 206f and 210f, of the tubing cutter valve assemblies, 206 and 210, respectively, are then actuated by the displacement of the tubular pistons, 206d and 210c, and thereby shear and crimp the ends of the corresponding sections of the coiled tubing 204. As a result, the coiled tubing 204 is divided up into three sections. Finally, the tubular piston 208c of the separator assembly 208 is displaced thereby shearing the shear pins, 208e and 208f, and displacing the tubular sleeve 208d away from the end of the housing 208a. As a result, the ends, 204a and 204b, of the coiled tubing 204 are separated by holding the ends of

the coiled tubing 204 using the pack off assemblies, 202 and 212, shearing the coiled tubing 204 using the tubing cutter valve assemblies, 206 and 210, and then separating the ends of the coiled tubing 204 using the separator assembly 208.

[0074] Thus, the system 200 provides a safe and highly efficient system for disconnecting coiled tubing. As a result, in the event of an emergency situation such as, for example, a blow out, the end 204a of the coiled tubing 204 may be quickly and safely disconnected from the other end 204b of the coiled tubing 204 thereby preventing damage to the remaining portion of the offshore platform 214. Furthermore, since the ends of the coiled tubing 204 are sealed off by the cutting and crimping operations, pressurized, and possibly flammable and/or toxic, fluidic materials within the ends of the coiled tubing 204 are not released to the atmosphere or sprayed on equipment or personnel on the offshore platform 214.

[0075] It is understood that variations may be made in the foregoing without departing from the scope of the invention. For example, while the present systems have been described for use on an offshore platform, the teachings of the present embodiments may be applied to land-based oil and gas wells, as well as any application in which it is desirable to disconnect one end of a tubing from another end of a tubing. Furthermore, the offshore platform may be a stationary or a floating structure, and may be located on any body of water.

[0076] Although illustrative embodiments of the invention have been shown and described, a wide range of modification, changes and substitution is contemplated in the foregoing disclosure. In some instances, some features of the present invention

may be employed without a corresponding use of the other features. Accordingly, it is appropriate that the appended claims be construed broadly and in a manner consistent with the scope of the invention.